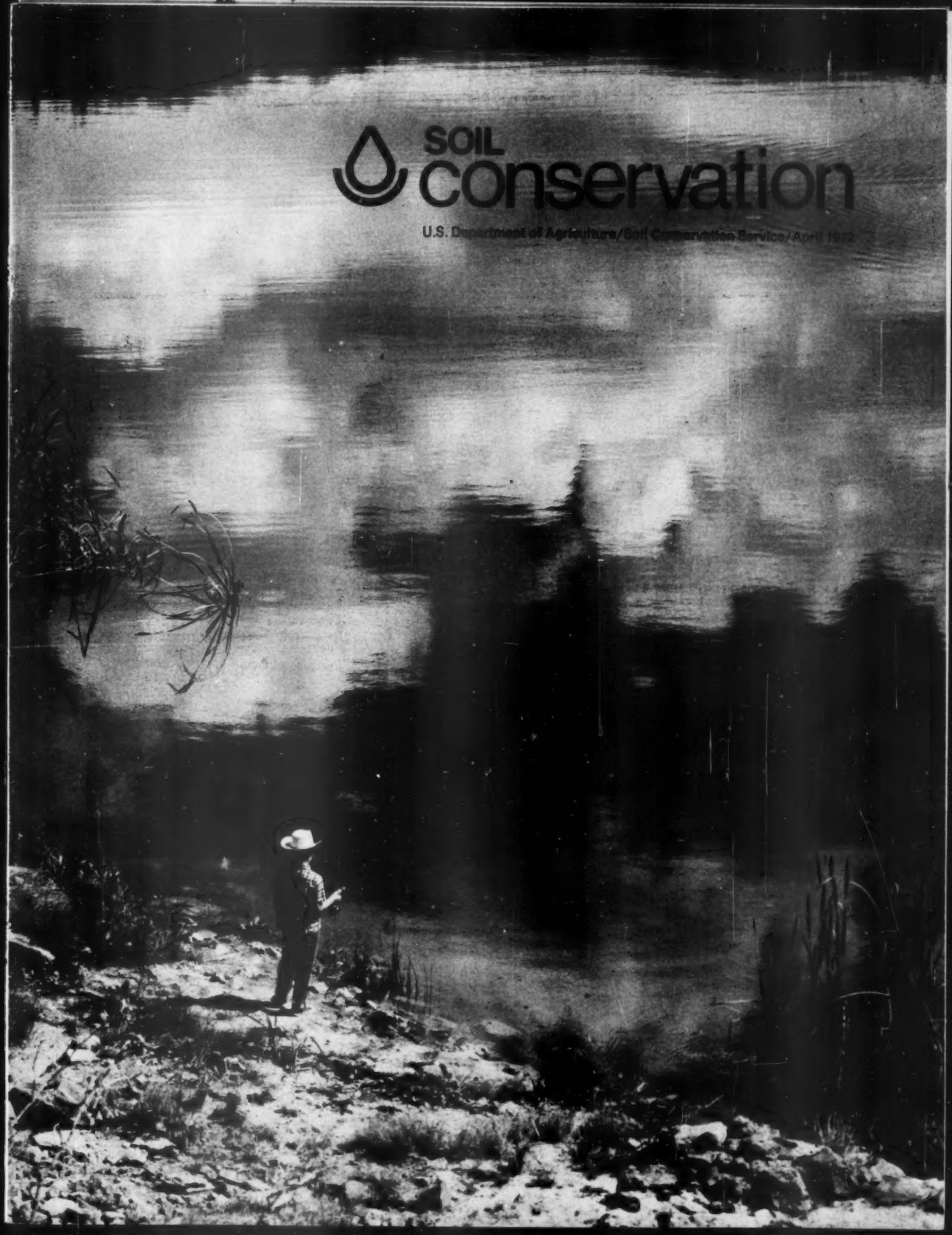
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In this issue of SOIL CONSERVATION, SCS Administrator Grant looks back 37 years—when SCS was new—then looks ahead to new challenges.

Water is an often mentioned word in this month's articles. California reports on the problem of disposing of saline drainage water; Sheldon Boone outlines the long-range water needs for the West; and Gordon Smith tells how houseowners in an Auburn, N.Y., neighborhood got rid of an unwanted backyard pool.

If you're in the market for a miniature horse, don't miss the article by John George.

COVER: Byron said, "Men really know not what good water's worth." Any boy out to catch a fish does.—Aspen Lake, Iron County Soil Conservation District, Utah.

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Prepared in the Division of Information, Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C. 20250.

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Problems associated with disposal of saline drainage effluent

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Disposal of saline drainage effluent has become a serious problem in some of California's irrigated-agriculture areas. A satisfactory solution lies beyond the purely technical aspects of developing physical processes or facilities to cope with this problem. Social and legal aspects must also be considered. Social pressures and awareness have brought tough new legislation as a step in precipitating a satisfactory solution.

California recently enacted the Porter-Cologne Water Quality Act, which requires the state to establish water-quality objectives and standards. The act also requires dischargers to submit a report of waste discharge, accompanied by a filing fee, to a Regional Water Quality Control Board. The board then issues permits and sets standards either for the quality of the discharge or the quality of the receiving water. The quality of both can then be monitored and close control maintained. Should the discharger fail to comply with board requirements the courts can levy fines of up to $6,000 per day.

The magnitude of the problem of disposal of saline drainage water can be illustrated as follows: In the San Joaquin Valley of California more than 1.5 million acres either need or will need drainage. This acreage can produce about 724,000 acre-feet of drainage water per year when under full development. Full development as used here means reuse of drainage water to a point where the quality is no longer suitable for agriculture.

Several years ago Congress authorized federal cost-sharing for the San Luis Reservoir and its irrigation delivery system to the San Luis service area. The project is to include facilities for collecting and transporting drainage waters from this service area. The plan was to collect the subsurface drainage water, transport it north, and release it into the Sacramento-San Joaquin River Delta for discharge in the ocean through San Francisco Bay.

Later consideration of the quality of this drainage water and its effect on the receiving waters

resulted in intensive investigations by several state and federal agencies to determine a means of reducing or controlling biostimulants such as nitrates. Drainage effluent contains about 20 p.p.m. nitrogen; water in the Sacramento-San Joaquin Delta, the proposed recipient of the effluent, contains about 5 p.p.m. With water-quality standards set at 5 to 7 p.p.m., some form of treatment process was needed to reduce the nitrogen content of drainage effluent to this level.

Six basic nitrate-removal systems were evaluated during a 3-year period:

(1) Algae stripping ponds designed to produce algae, thus concentrating the nitrates and producing a commercial byproduct.

(2) Covered 15-feet-deep ponds designed to minimize algae growth and wind-mixing. The system operates under anaerobic conditions; it is fed with methanol for bacterial metabolism.

(3) Vertical filter systems, which use methanol as a carbon energy source for bacterial metabolism associated with anaerobic denitrification.

(4) Symbiotic pond systems—a process whereby algae and nitrate-reducing bacteria live together in a mutually beneficial relationship.

(5) Shallow ponds—in these, water is about 6 inches deep and is spread out as in a ricefield. Grass is grown in the pond as the carbon source for bacterial metabolism.

(6) Eight-feet-deep ponds that are fed barley straw as the carbon source for anaerobic bacteria.

In a seventh system now being evaluated, submerged tile drains promote anaerobic denitrification.

Denitrification leaves a product that can be used in ponds for wildlife and fish, including catfish, and perhaps for industrial cooling.

The next logical step in the treatment process would be desalinization.

The present methods proposed for desalinization are reverse osmosis, solar distillation, and distillation with atomic power. Reverse osmosis appears to show the most promise at present. Solar distillation is inexpensive but is not feasible in the Central Valley at this time. Atomic power to supply heat for distillation of saline waters is a possible method but may be too costly.

Several alternative sites for the disposal of drainage effluent were considered during the investigation. Discharging into the lower part of the Sacramento-San Joaquin Delta near the town of Antioch, Calif., was selected as the least costly alternative, compared to pumping water over the coastal range of mountains and discharging it into Monterey Bay or constructing a closed outfall into the ocean.

Presently a facility is being constructed to collect and transport drainage effluent to the Kesterson Reservoir east of the town of Gustine. Storage at this site is a temporary expedient pending resolution of the quality problems associated with outletting the drain into the delta.

Considering the present amount of drainage water produced and the anticipated rate of development and evaporation, the Kesterson site has about a 10-year capacity for storing drainage effluent without outflow.

Reclaiming drainage water for multiple secondary uses such as algae production, catfish farming, and industrial cooling may yet prove feasible. Future research might lead to the use of saline water on excessively drained cropland or to more practical ways of desalting drainage effluent. ♦

Salinity– multiple headaches for planners

by Glen H. Loomis
Soil conservationist
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Washington, D.C.

"Summer snow" and "black alkali." These colorful terms describe the symptoms of a widespread and severe problem faced by many farmers and ranchers in the West.

In some areas, the land turns snow white as salt crystals form on the surface, virtually eliminating all plant growth. In other areas, the salt accumulation forms a black crust over the land.

This salt problem is not new. Salt related problems plagued ancient civilizations. Early Babylonians used the Tigris and Euphrates Rivers to irrigate the fertile valley lands. Eventually, silt and salt accumulations forced much of the land out of production. Today, this same area supports only about one-sixth the population it did centuries ago.

In irrigated areas, excessive application of water often triggers numerous problems. Excess water, poor quality water, and marginal soils add up to total loss of productivity in some areas. Poor water management coupled with a poor understanding of the potential complications often result in vast alkali flats that require extensive reclamation practices if they are to be restored to productivity.

More than 42 million acres were classified as irrigated lands in 1965. Almost 111 million gallons of water were withdrawn each day from our nation's water supply to irrigate these lands.

The salt content of irrigation waters ranges from a few hundred pounds to several tons per acre-foot. Water supplies for downstream users become more saline as salts are leached from irrigated soils into drains and then into rivers. Salt buildup is an existing or potential danger on almost all irrigated lands, including humid coastal areas where brackish water is used for irrigation. Salinity is a growing problem on nonirrigated cropland and rangeland. Saline seep areas have increased in the Northern Great Plains States. All of these areas need proper management if they are to be used efficiently.

It is apparent that poor drainage, overirrigation, and poor water quality can bring swift destruction to unsuspecting farmers and ranchers.

Salt balance

Maintaining or improving the salt balance in problem areas is a difficult task. Suitable water quality is as important as adequate quantity in meeting irrigation needs. Leaching is normally essential to the maintenance of sustained productivity and the maintenance of a salt balance. This means that of the total water applied, a sufficient amount must percolate through the crop root zone and remove enough of the dissolved salts to maintain root zone concentrations compatible with the crops to be grown. The salts removed should equal or exceed the salts applied through irrigation and fertilizers.

Salts dissolved in irrigation water collect in the root zone after repeated applications of water.

(Above) An adequate water supply, good soil, and appropriate water management add up to an excellent corn crop in Frio County, Texas. (Right) Poor water management, high salt concentrations in the water supply, and poor drainage add up to lost production in California's Imperial Valley.

Only negligible quantities of salts are removed by crops. Evapotranspiration adds to the salt concentrations as soil moisture is depleted.

Excessive quantities of sodium, biocarbonates, boron, chlorides, pathogenic organisms, and suspended solids in irrigation water limit production of many crops. Excessive amounts of water are used for leaching in some areas to retard heavy salt buildup. In extreme cases, fields are taken out of production for one planting to flush the salt accumulation from the root zone.

River basin planning and salinity

River basin planning offers a unique opportunity to address the interrelated conditions associated with salinity problems. Past planning efforts often considered irrigation, drainage, water quality, and soil suitability as independent planning units. This provided a fragmented and often inefficient solution to the total problem. Drainage needs should not be considered without irrigation. Irrigation needs should not be studied without considering water quality.

River basin planners are concerned with all resource problems. They are faced with questions about availability of water, timing of supply and demand, water quality, management demands, conveyance losses, return flows, salt balance, drainage requirements, quality of drainage effluent, ground-water supplies, and conjunctive use of water resources.

The Sevier River basin study in Utah brought about a unique water-budgeting program using an analog computer to better understand such interdependent relationships. The results of this study can provide useful information to enable cooperating groups to better manage the basin's total water resources and allow maximum use by fish and wildlife in conjunction with irrigation.

The recognition of suitability of soils for irrigation is a prime requisite for success in any irrigation endeavor. Some areas where salinity is a problem can only grow salt-tolerant crops.

New concepts in basin planning

Comprehensive planning allows for considering national and regional development objectives concerning the use and allocation of our resources. This includes the social and environmental issues that influence the planning process. Comprehensive planners must consider the possible alternatives by which they can meet irrigation and drainage needs compatible with environmental concerns. Basinwide planning provides the proper framework for examining the interactions of the following factors affecting the salt balance: (1) quality and quantity limitations of surface water; (2) quality and quantity limitations of ground water; (3) reliability of supply; (4) timing of supply and demands; (5) return flow to streams—quantity as well as quality; (6) return flow to ground-water bodies; (7) recoverability of ground water; (8) excessive onfarm use; (9) water use by phreatophytes; (10) tailwater return systems; (11) high conveyance losses; (12) evaporation; and (13) fish and wildlife habitat.

Opportunities for solution

Numerous methods are available by which planners can alter salt concentration conditions. Storage of good quality water for release during critical low-flow periods maintains suitable water quality in streams. Water treatment is expensive but positively insures suitable water quality. Diverting poor quality springs into evaporation ponds is being tested in the arid West as a method of reducing the salt load in streams and rivers. Proper water management contributes significantly to maintaining the salt balance on irrigated lands. Canal lining helps to reduce unnecessary seepage.

Possible ways of controlling salinity in the Colorado River include plugging salt wells and springs, desalting the flow of springs, controlling municipal and industrial waste loads, and minimizing the pickup of salts from the streambed. As an example, Blue Springs, a large spring near the mouth of the Little Colorado River, contributes a salt load of about 547,000 tons per year, or approximately 5 percent of the annual salt burden at Hoover Dam. A salt load reduction project is proposed to control the outflow from Blue Springs and make 140,000 acre-feet of demineralized water available for use in central Arizona.

It is obvious that many problems are associated with trying to balance competing demands for our water and land resources. But demands can be complementary. For example, drainage effluent can provide a water supply for wildlife areas.

Proper water management in conjunction with conservation practices can contribute significantly to solving many present and potential irrigation and drainage problems. Hopefully, in the future, "summer snow" and "black alkali" will become seldom heard terms. ♦

Long-range water needs for the West

by **Sheldon G. Boone**
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How can the natural resources of the West serve the needs of today and still be conserved to meet the needs of future generations? Enlightened planning at local, state, and federal levels is a must.

One of the national efforts to bring about enlightened water-resource planning in the 11 Western States resulted from the Colorado River Basin Project Act of 1968 (Public Law 90-537). This bill authorized the Western United States Water Plan Study, known as Westwide. The Department of the Interior has leadership in a coordinated federal effort to do the following:

(1) Determine the water supplies available;

(2) Determine the long-range water requirements;

(3) Determine the most economical means of augmenting the Colorado River;

(4) Develop a general plan to meet the future water needs of the entire Western United States.

The U.S. Department of Agriculture is cooperating in this study under the leadership of the Soil Conservation Service. The Forest Service and Economic Research Service also are participating. One of the important assignments under SCS leadership is to fix water requirements; these will provide data for developing alternative state water-resource plans.

Current water use

The surface-water supply in the 11 Western States is estimated at more than 500 million acre-feet yearly. More than 30 million acre-feet of water are pumped from ground-water acquifers; this results in an overdraft exceeding 6 million acre-feet. Water consumption is estimated at more than 70 million acre-feet. These figures alone do not cause alarm, but in the West there are areas of scarcity as well as of plenty.

In the water-abundant Columbia-North Pacific Region, only 5 percent of the 378 million acre-feet water supply is consumed in a year. In the Upper Missouri-Yellowstone River Region, 20 percent of the water supply is consumed. About 40 percent of California's supply is consumed, and nearly all of the supply from the Colorado and South Platte Rivers and that from the Rio Grande River are consumed.

Consumption exceeds supply in the Great Basin Region, because there is no outflow from the region and terminal lakes generally are receding. Water withdrawals, however, are two to four times the consumed amounts. In many basins where water use is high and streamflow dwindles, salinity increases and poor water quality results.

About 60 million acre-feet of water are consumed in irrigating 27 million acres of cropland and pasture. This accounts for 85 percent of all water consumed. This figure includes losses incidental to irrigation. In addition, riparian phreatophytic vegetation in some areas reduces water supply available for economic development as much as 40 percent. The recovery of water through salvage, resulting in increased streamflow, must be weighed against possible loss of some wildlife habitat.

Municipal and industrial use, including thermal power and mining, presently account for less than 1 to more than 10 percent of the water consumed in resource regions of the West.

Although consumptive use is small for such purposes as fish and wildlife, recreation, hydropower, navigation, and water-quality management, the instream flow requirements are significant in many basins. For example, requirements for navigation below Bonneville Dam on the Columbia River amount to 58,000 cubic feet per second, equal to an estimated 42 million acre-feet annually. This water, however, is jointly used for fisheries, recreation, hydropower, and water-quality management. The maintenance of streamflow for summer fisheries is in direct competition with critical-period irrigation diversions in many streams in the West.

Potential water savings

Water consumed by crops accounts for only 70 to 85 percent of the water depleted in the process of agricultural irrigation. Improved water conservation and irrigation management can result in savings of several million acre-feet of water. Cutting incidental

Water Requirement Data to be Collected

Function	Offstream requirements		Instream requirements		Agency responsibility*	
	Withdrawal	Consumptive use	Instream flow	Consumptive use	Lead	Assist
Municipal and industrial	X	X			EPA	ERS; SCS; FS
Agricultural—						
Irrigation	X	X			SCS	BR; BIA
Livestock	X	X			SCS	BLM; FS; BIA
Electric power—						
Thermo	X	X			BR	FPC
Hydro			X	X	BR	
Minerals	X	X			BM	
Recreation	X	X	X	X	BOR	FS
Wild and scenic rivers			X	X	FS	BOR
Fish and wildlife	X	X	X	X	BSFW	
Estuaries			X	X	BSFW	
Terminal lakes			X	X	GS	
Quality management (undesignated to function)	X	X	X	X	EPA	
Navigation			X	X	BR	CE
Natural losses (phreatophytes, etc.)			X	X	SCS	
Nonirrigated wet meadows (wetlands)			X	X	SCS	BSFW
Artificial ground-water recharge	X	X			GS	
Export (transmountain diversion, etc.)	X	X			GS	
Legal and institutional—						
Treaties, etc.	X	X	X	X	BR	
Evaporation from regulating reservoirs	X	X			BR	

* BIA—Bureau of Indian Affairs; BLM—Bureau of Land Management; BM—Bureau of Mines; BOR—Bureau of Outdoor Recreation; BR—Bureau of Reclamation; BSFW—Bureau of Sport Fisheries and Wildlife; CE—U.S. Army Corps of Engineers; EPA—Environmental Protection Agency; ERS—Economic Research Service; FPC—Federal Power Commission; FS—Forest Service; GS—Geological Survey; SCS—Soil Conservation Service.

losses to irrigation in half could provide 5 or 6 million acre-feet of new water to the Westwide area, where it is desperately needed. In riparian phreatophytic areas also, the water salvage potential can provide several million acre-feet of water to deficient areas. For example, viable programs are needed for salvaging some part of the 700,000 acre-feet of water now being uneconomically used in the Rio Grande Region in Colorado and New Mexico.

Reducing regulatory waste, spills, and other losses provides potential for water salvage in many areas. A part of the 1.4 million acre-feet of water lost in the water-short Lower Colorado Region has salvage potential. Conservation and salvage of water in water-short areas are viable alternatives to augmenting current water supplies.

Water productivity

Within appropriate environmental, institutional, and social guidelines, regional water planning must also be concerned with efficiency in water use or productivity of water. The concept of "productivity increases," long used with regard to labor and land, should be applied to water. Where available water is a limiting factor to a farmer, an industry, a recreational or urban development, plans should be developed to maximize the output of goods and services per unit of water use.

Studies on the South Platte River in Colorado have shown that, in the last 30 years, water used for irrigation increased 60 percent, and the value of crops produced (constant dollars) increased 350 percent. The increased use of water through fuller water supplies, improved systems, and more timely application of water no doubt accounted for much of the increased production, but other factors were important also. Improved crop varieties, better management, fertility practices, and soil conservation practices, along with the selection of higher value crops, also helped increase output. The "productivity increases" concept must be applied to all water uses if future demands are to be met.

The importance of determining water requirements

Determining long-range water requirements, one of the objectives of the study, is paramount to developing a water plan. Unless water requirements can be determined with some accuracy, no dependable plans can be developed. A sound approach is to

develop a range of alternative requirements based on a different set of assumptions regarding the effect that technology, cost, and other factors could have on water use. For example, how much water will be consumed in producing a bale of cotton in the year 2000 or 2020? Because water requirements for a given acre of cotton vary only slightly, regardless of yield, the most important factor then becomes the yield of cotton per acre. If this is known, the water required to meet a stated demand for cotton can be determined.

But the factors affecting crop yield are many. Yields might be influenced by farm policy, net farm income, production costs, levels of cultural and water management, and the use of agricultural chemicals, to name a few.

The scarcity and cost of water also influence the efficiency of water use. Urban areas, by plan, can either conserve water or use large quantities inefficiently. The number of irrigated parks, golf courses, or open spaces is a major factor. Industrial use will vary, depending on water availability and recycling costs and constraints on waste disposal.

More and more decision makers are demanding an analysis of alternative approaches and plans before making decisions concerning major water uses. The Westwide effort will provide a comprehensive view of the West's water requirements, which is needed to develop alternative solutions and resolve conflicting uses. It will provide a dynamic and flexible base for updating, modifying, or redirecting the water supply to its best use. ♦

Little horse, big business

by John C. George
Soil conservationist, SCS
Norristown, Pennsylvania

What do Merchant Marine officers do after they retire? Raise miniature horses? Tony Garulo does—at the Gettysburg Miniature Horse Farm in Adams County, Pennsylvania.

Garulo, while on a voyage to Argentina aboard the McCormick Line freighter that he captained, heard stories about tiny horses—only 28 inches high.

Reaching Argentina, Garulo and two friends from the McCormick Line visited the Falabella Ranch. They liked the wee horses and also Garulo's idea of creating a tourist attraction and sales outlet for the horses in this country. Garulo, Don Rohe, who lives in New Jersey, and a third partner in Argentina formed a legal partnership. After Garulo retired, they set out to make the idea a reality.

The unusual breed, which was established by the Falabella family of Argentina, is a pint-size version of standard breeds, including Pinto, Palomino, Appaloosa, and Clydesdale. The horses, on the average, are 28 inches high; some are much smaller. They weigh between 70 and 125 pounds. The Falabellas have a horse that weighs only 25 pounds.

"People often ask me what the horses are used for," says Garulo. "I tell them they can do anything a big dog can do, and more. These horses are intelligent, gentle, and easily trained. They can pull small carts with light loads. A child weighing about 80 pounds can ride a little horse."

The Falabellas established the miniature horse over a period of about 100 years. Garulo says, "The breeding technique involved in miniaturizing these horses is a well-guarded family secret. There are only about 300 of these horses in the world." Garulo

(Left) Tony Garulo's miniature horses, brought to this country from Argentina, are attracting tourists to Adams County, Pennsylvania.
(Opposite page, top) Fernando, a helper who came to this country from Brazil, shows off his favorite mini-horse.
(Opposite page, bottom) SCS helped with the layout and design of this pond on the Gettysburg Miniature Horse Farm.

hopes that in the near future Señor Falabella will come to Adams County and show him how to breed these horses.

Garulo has about 47 of the wee horses at his farm in Adams County—the largest number outside of Argentina. The horses were shipped by plane to Florida, where they were quarantined for 3 days, and then on to Adams County by truck.

Before Garulo decided to settle in Adams County, he looked at properties in many states. Most of the areas he investigated lacked the tourist attractions that were needed to get his commercial recreational development started. "When I finally got to Adams County, I knew I wanted to settle here," says Garulo. "With the National Military Park in the area, plus extensive development of the tourist industry in and around Gettysburg, the area had just what I needed for my business."

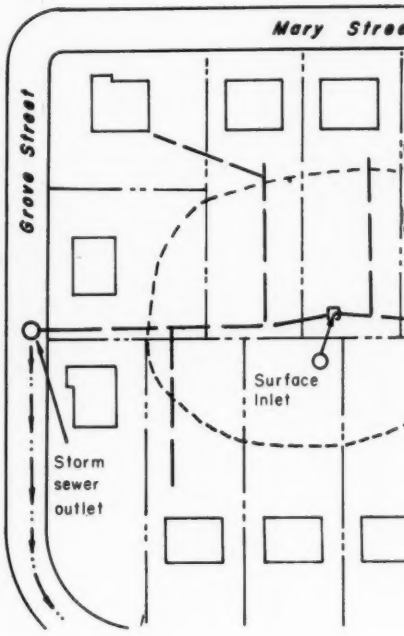
Garulo's experience with farms and livestock was rather limited. Because of his scant agricultural knowledge, he sought as much technical assistance as he could from state and federal agencies, including the Soil Conservation Service.

Garulo originally went to SCS for technical help in building a pond. The pond was to serve as a focal point for the 100-acre recreation enterprise and also to supply water for his stock. When Garulo learned about farm conservation plans from the SCS people, he immediately signed up as a cooperator with the Adams County Soil and Water Conservation District.

Garulo used his conservation plan as the basis for developing his entire enterprise. The architect hired to make a master development plan used SCS soils information and interpretations in finding sites for the buildings.

Garulo puts it this way: "Before we knew what kind of soils we had, we just guessed where to put our new barn, restrooms, refreshment stand, and cottages. But now the soils data determine the final decision on placement. As far as I'm concerned, any development not based on soils information is not a very intelligent one." ♦

Drying out a neighborhood



(Left) After almost every storm, landowners along Mary and Grove Streets had an unwanted pool in their backyard. It attracted debris, mosquitoes, and the neighborhood children.
(Center) A tile drainage system, running through several backyards, drains the water out of the lowland and carries it to a storm sewer in the street.
(Right) James Hotaling, Cayuga County Conservation District manager, left, and Canio Maggio, a neighborhood resident, examine one of the drop inlets of the drainage system.

by Gordon S. Smith
Public information specialist, SCS
Upper Darby, Pennsylvania

In the right place, a pond can be a real asset. In the wrong place—for example, your backyard—a pond can be a hazard.

In Auburn, New York, 2 years ago, 14 families along Grove and Mary Streets had a backyard pond they didn't want.

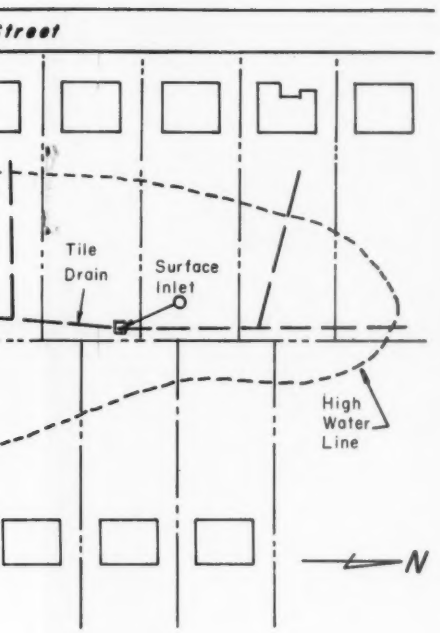
Such ponds and wet acres are not uncommon in this central New York area. Pockets of wetland, an aftermath of the glacial epoch, dot the countryside. The 14 families in Auburn live on the edge of a new housing development that borders one of these large wetland areas. In fact, SCS soil maps indicate that the area was part of a swamp 15 years ago. Fill had been added, and houses had been built as the city expanded.

The water hazard didn't appear until the last few houses were built along the lower side of the one-block area. Elevating the front yards of these new houses resulted in a low dike across the back end. A prolonged rainy season formed the unwanted pond as runoff was bottled up behind the houses.

"Our backyards became a community health hazard," recalls Canio Maggio, one of the houseowners. "The stagnant water attracted almost as many neighborhood kids as it did mosquitoes. Something had to be done."

A dozen truckloads of fill were hauled in by the houseowners in a losing battle with the pond. The poor results forced them to look for a better way to get the water out of their yards.

First, they asked the city mayor, Paul Lattimore, for help. The mayor was sympathetic but could not solve the problem entirely. The Auburn Public Works Department could extend storm sewers to a point on the street near the water problem. But the drainage system needed to carry water from the wet area to the storm



sewer would have to be constructed at the landowners' expense because the system would run through private land. Mayor Lattimore advised the group to contact the Cayuga County Soil and Water Conservation District for help.

Conservation district officials agreed that the problem was serious. They asked Charles Barnett, SCS district conservationist in Cayuga County, to give technical assistance.

It was decided that a simple underground tile drainage system running to an outlet in the street could remove the water. The same system on a larger scale is used by farmers to remove excess water from their fields.

The backyard drainage system consists of 6-inch tile running 450 feet in a straight line from the upper part of the problem area, under the wet area, and through Maggio's side yard to the street where it connects with the city's storm sewer. Maggio's house is on one of the lots that formed the water-blocking dike.

Two vertical drains placed at the lowest points in the wet area and directly above the tile line let surface water down into the tile line. Several 4-inch-tile lines branch out from the main line.

At the street end of the drainage system, the city installed an outlet to the storm sewerline.

Cost of the project was estimated at just under $1,000. Each of the landowners paid $86.50. Several of them arranged for additional tile drainage under their yards. At very little added expense, this made the drainage even more effective.

The neighborhood drainage project was finished in a few days, and almost immediately the wet backyards showed signs of drying out. The landowners seeded the area and landscaped it with flowers and shrubs.

Maintenance has proved to be a minor chore, according to the landowners. About twice a year they clean out the two surface inlets. They keep a small bank account to handle repairs, but repairs have not been needed yet.

Many heavy rains have hit the area in the 2 years since the drainage system was installed. Each time, water ran into the surface inlets leaving the once-flooded backyards as dry as other parts of the block.

"You could say a big neighborhood problem went down that tile drain," comments Maggio. "The general appearance of our block has been greatly improved. Property values are increasing each year. There's just no way to measure the dollar value of this drainage work" ♦

Acres and acres of classroom

by Clifford C. Sorensen
District conservationist, SCS
Stockton, California

Long before ecology became the vogue word it is today, Edith Friedlaender Bondi of Oakland, California, was intent on teaching conservation to young people.

Mrs. Bondi, the wife of a consultant to Shell Oil Company, Arnold Bondi, has turned a 200-acre ranch in the hills of southeastern Alameda County near San Francisco Bay into an outdoor classroom for environmental studies.

Mrs. Bondi calls the ranch Timna, because the mountainous area looks so much like Timna in Israel where King Solomon's Mines are located. She has set up a nonprofit organization—Timna Foundation, Inc.—to operate the ranch for the education of youth.

"There are two mountains and two and a half canyons on the property," says Mrs. Bondi, "and a creek that flows under rocks in the summer. Plants other than grass include mostly digger pine, oak, juniper, and manzanita on the slopes and mountain mahogany and willow by the creek. Deer abound in the area, as do valley quail, owls, and hawks. There are even coyotes, which are sometimes heard at night."

Mrs. Bondi signed up as a cooperator with the Eastern Alameda County Resource Conservation District in 1967. Then she went to the Soil Conservation Service office in Livermore for advice in developing her ranch as an outdoor classroom.

She received onsite help in planning a pond, an access road, hiking trails, and a septic-tank disposal system.

The SCS staff at Livermore also provided maps, instruction on how to build watering devices for birds, and help in developing and maintaining wildlife habitat. On their own time, they assist with outdoor class instruction at Timna, discussing soils, grasses, and the topography of the area.

The youth education ranch provides many learning opportunities. Students explore the grounds and study plants and how they relate to the sun, the slope, and other soil and climatic conditions. The older youths sometimes help teach the younger ones.

Youngsters, from third-grade age to age 15, come not only from Oakland, Livermore, and other communities in Alameda County but also from other parts of the United States. A few come from Israel, France, and Morocco. Some are there for a day—arriving in the morning and leaving in the afternoon. Others stay for the 11-day session.

Mrs. Bondi has been teaching in public schools in New York and Oakland for more than 30 years and has worked with Girl Scouts and with boys and girls of her own Jewish faith. Many a former Girl Scout sends her offspring to Mrs. Bondi for the summer sessions at Timna.

Mrs. Bondi says outdoor learning areas can be of tremendous assistance to teachers. "With the help of books, pamphlets, and other material on conservation, teachers can prepare youngsters in the classroom for outdoor sessions," she says. "At Timna, the young people have a sensory contact with real examples of what they have studied indoors. I try to open up youngsters' eyes to the outdoors."

There are no roads on the ranch. "I am not permitting any vehicles whatsoever," Mrs. Bondi says. Timna has a new cabin with bathroom facilities, a meeting room, and a museum for exhibits explaining Timna flora and fauna. The students prepare these exhibits with their own drawings, poems, and reports. The old lodge is occupied by caretakers who live there year-round. There's a pond for fishing and studying water-related plants and wildlife.

Mrs. Bondi also conducts outdoor classes for teachers, college students studying to be teachers, and high school students. Resource specialists from SCS and other agencies often assist. Classes are limited to 12 students at any one time.

"I've always enjoyed working with youngsters," Mrs. Bondi admits. "My husband, our daughter and our son, and I enjoy hiking and have learned a lot from nature trails in national parks. I am trying to reproduce something like that for youngsters at Timna."

Mrs. Bondi's efforts in stressing the importance of conserving our natural resources to youth and the community have not gone unnoticed. The Eastern Alameda County Resource Conservation District selected her as the "outstanding conservationist" for 1971. ♦

Reading, 'riting, and 'rithmetic—not in this classroom.

Green tees and dry fairways

by Don Brackett
District conservationist, SCS
Gresham, Oregon

Golfers used to say that to play Portland's Riverside Golf and Country Club course in winter or spring it helped to have web feet.

Playing in those rainy months often meant wearing rubber boots or returning to the clubhouse with water in your shoes. On many days, although other courses in that part of Oregon were busy, the Riverside course was unplayable.

The problem was frequent flooding by surface water. The area, in the Columbia River flood plain, has deep, naturally fertile soils that are poorly drained.

Past efforts to improve conditions on the golf course had been only partly successful. Three small pumps and several thousand feet of drainage tile could not accommodate the water from winter and spring rains. For days, fairways were nothing less than water hazards, with standing water, soggy soil, and drowned-out turf.

Club members for years had considered overhauling the drainage system and rebuilding the golf course. A larger membership and heavier use of the course eventually brought the decision to go ahead.

In 1969, a golf course architect drew up plans for the rebuilding. The next year the club persuaded Dick Malpass to take the job of course superintendent.

An immediate step by Malpass was to visit the East Multnomah Soil and Water Conservation District and ask for help in upgrading the drainage system for the golf course.

It was estimated that nearly 30,000 feet of tile, a 30-horsepower sump pump, and a 12-inch turbine pump would remove the excess water efficiently. The existing tile would have to be discarded. It was considered inadequate to do the job.

In the fall of 1970, contractors installed 20,000 feet of tile and a new pump station. Two small lakes were built as holding ponds, but they were located for maximum scenic effect.

The drainage system passed a major test in January of 1971. A warm chinook wind and 1½ inches of rain on 8 inches of snow produced what could have been course-saturating conditions. The new system, however, carried 4 million gallons of water off the course within 24 hours. The pumps handled the water at the rate of 4,250 gallons a minute, discharging excess water into the nearby county-maintained drainage canal. Golfers played the course the following day.

Wild ducks have found the golf-course lakes to their liking. At least five broods have been hatched there and have remained on the lakes.

Maintenance crews have planted dwarf purple willow and silky dogwood for beauty and erosion control. There will be other plantings to provide food and cover for birds and other wildlife.

Members of the Riverside club are delighted with the results of their investment in the drainage program. The course, they report, is no longer a "part-time golf course and part-time swimming hole." ♦

(Below) This tiny lake is a beauty spot on the Riverside Golf and Country Club course near Portland, Oregon. It does double duty as a holding pond in a new drainage system.

Dry dam saves cropland

by George J. Newberger
District conservationist, SCS
Upper Sandusky, Ohio

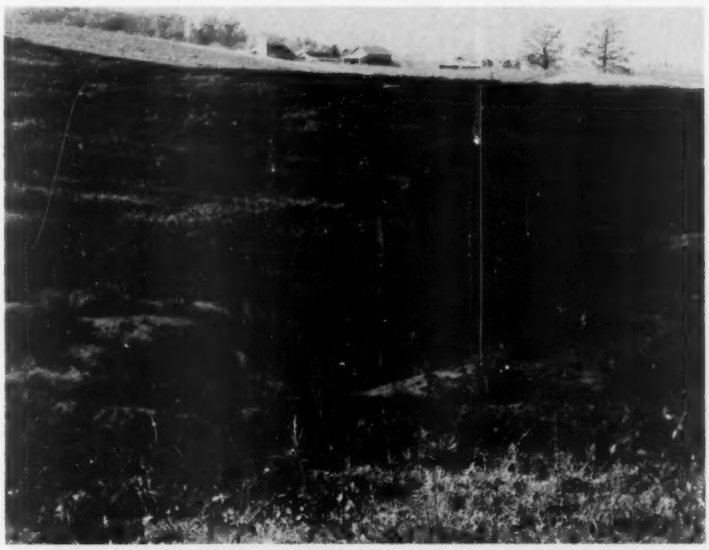
"Yes, I'm interested in saving Lake Erie, but I want to start by saving my own soil right now." This statement was made in 1970 by Tom Reber. He is now saving his rich bottom land on the Sandusky River and helping to protect Lake Erie too.

"We had learned to live with the flooding caused by backwaters of the Sandusky River," states Reber, "but the gullying and washing away of productive soil was too much to accept."

Of the 800 acres in the Tom Reber farm south of Upper Sandusky, Ohio, in Wyandot County, about 350 acres are highly productive, nearly level bottom land. Water from the nearby uplands has to flow across the bottom lands on its way to the river. And that's what brought on the trouble.

Assistance from the Soil Conservation Service in solving land-use problems was not new to Reber, but this time what did he need? A diversion, a waterway, tile? He didn't want a grassed waterway using up his cropland. And the cost of enough tile to handle all that water—"that would take all the fun out of farming," quipped Reber.

SCS suggested a dry dam. Reber thought it over and accepted the suggestion. The dam would be just like his farm pond, only it would be dry most of the time. It would capture storm water draining from the 80 acres uphill and hold it temporarily. A perforated pipe would ease the water out of the pond and into 10-inch subsurface field tile that would carry the water harmlessly into the Sandusky River.



(Top) This dry pond stores water during periods of heavy rainfall and runoff and releases it slowly through a 10-inch subsurface tile system. The standpipe, in the center, keeps discharge within tile capacity.
(Above) Another view of the pond holding runoff from a 12-hour, 3-inch rainfall. The pond empties in about 30 hours and is ready for the next storm.

When Reber got the cost estimate for the dry dam, he thought he would be spending a lot of money for a pond he couldn't use. The Rural Environmental Assistance Program of the Agricultural Stabilization and Conservation Service helped by paying part of the construction costs.

Was it worth it? "That dam really works," reports Reber. "We had three bad storms last spring, and each one dumped 3 inches of rain on us in less than 12 hours. The dam held every bit of it. Each time, the dam emptied in about 30 hours and was ready for another storm." ♦

conservation in action

MIADS all in a row

There's a new "handmaiden" in the Soil Conservation Service's River Basins Division. Her name is MIADS, and she works with untiring diligence, speed, and precision.

MIADS, actually MIADS/360, is the acronym for "Map Information Assembly and Display System," an automatic data processing system coded for use on IBM System 360 computers.

The first version of MIADS was developed by the USDA Forest Service's Forest and Range Experiment Station in Berkeley, California, in 1964. Since then, MIADS has grown up into a "real beauty."

The system consists of a set of four relatively simple computer programs and one IBM "package" program. Each program in the series performs certain fundamental operations that involve manipulating and processing "point-areas" mapping systems. MIADS isn't very sophisticated in terms of what is possible at the state-of-the-art level of automatic data processing, but it can combine various operations in diverse orders and sequences to provide a powerful, flexible, and economical tool for processing planimetric maps.

MIADS can:

(1) Create and maintain a master file of coded data for a series of maps for any project area.

(2) Translate or convert sets of codes from one or two base maps to a new set of codes on a new map.

(3) Combine and merge original or translated codes from two maps to derive a new map.

(4) Perform frequency counts and expansions for the various codes that comprise a map and summarize the contents of a map.

(5) Graphically display the maps on a printer if desired.

MIADS is a computer-facilitated program that produces "symbolized" maps or tabulations or both. Simply, MIADS works like this:

(1) Base maps are prepared depicting the physical location of the desired category.

(2) Transparent grid sheets are placed over the base maps and fixed to established reference points on the maps. Each cell on the grid sheets can represent 1,000 acres, 100 acres, 40 acres, 10 acres, or whatever size area is preferred.

(3) The desired data, in coded form, are transferred from each base map. Coded symbols, for example, for showing only a few of many kinds of ownership possible for the system are: NF for national forest; NP for national park; PD for public domain; PT for privately owned land; and MR for military reserve.

(4) The data from the coded grid sheets are then transferred onto punch cards for input to the MIADS computer program. MIADS output can be in the form of computer-produced maps or tabulations.

The system can be used to combine two or more categories. For example, maps and tabulations showing areas of coniferous cover in national forests can be made by combining cover type and ownership categories. Also, boundary changes of planning units or other specific areas can be coded into MIADS. All previously recorded data can then be extracted by these new delineations. Through MIADS, updated information can be added to the computer system to provide a continuing and current "data bank" of valuable information for quick retrieval. Clearly, the system can combine thousands of combinations of interchangeable units of specific data.

Given the required base maps, MIADS can be part of the means for direct, accurate answers to questions like these:

> How much privately owned land in the W watershed of X county of project Z is subject to moderate or severe flooding? And where is it?
>
> How much land predominantly unsuitable for cultivation in Y county under project Z is currently being used as cropland? As pasture? As forests and woodland?
>
> Where, within 10 miles of city A, are all potential sources of pit gravel suitable for fine and coarse concrete aggregate?
>
> Where and how much land has been converted from cropland to some other agricultural use within the last 5 years? From agricultural use to urban or residential use?

Neither MIADS nor other similar systems can immediately or completely answer questions like

these. But a competent technician can easily state these diverse selection criteria through a series of explicit commands to MIADS, using the related base maps, to get either the answers or summarized data. The technician need not be a computer expert. The "language" of the system can be learned in as little as a day.

Already, MIADS has been of considerable value in river basin planning. The system has been used in the California Region Comprehensive River Basin Study covering approximately 100 million acres; the Lower Colorado Region Comprehensive River Basin Study covering more than 90 million acres; and the Southwest Washington State area. Colorado, Texas, Alabama, Kentucky, West Virginia, and Illinois are in the process of initiating the program. And many other areas are considering a conversion to this versatile program, truly a beauty of a system.—GLEN H. LOOMIS, *River Basins Division, SCS, Washington, D.C. and* GEORGE E. MCGRATH, JR., *Information Division, SCS, Washington, D.C.* ♦

Basin leveling saves water

Basin leveling saved John Fornes of Buckeye, Arizona, enough water on a 70-acre cotton crop to irrigate 50 acres of alfalfa—and he did it with salty, silt-laden irrigation water.

A supervisor and cooperator with the Buckeye Soil Conservation District, Fornes has farmed several years in the Buckeye area. During this time he has been looking for answers to a variety of problems.

Soft sell for clear water. (Photograph submitted by Doug Culhane, district conservationist, SCS, Sioux Falls, South Dakota).

After he developed his overall conservation plan with Bob Tobin, former SCS district conservationist at Buckeye, he decided to try basin leveling to solve some of his problems. He started on his toughest area—one with two serious problems: tight soil and poor quality water.

Sources of water for this area are the Buckeye Canal, which receives its supply from underground, and the Gila River. Mixed ground water and surface water averages 2,800 parts per million of salt. Sometimes, when only wells near the farm are used, salt content can reach 5,000 parts per million. More than 2,500 parts per million of salt can cause a serious problem.

The water is also high in sodium, which creates even more of a problem. In addition, water from the Gila River carries a large amount of silt, which seals surface soils and practically stops water from moving into them.

SCS people studied the area and gave Fornes several alternative leveling designs. Fornes elected to break the field into 10-acre benches, 330 feet wide and 1,320 feet long, with no slope in any direction. After leveling, he put the field into a good conservation-cropping system.

Today Fornes can see many significant results. Before leveling, he used 8 acre-feet of water per acre; today, he uses only 4½ acre-feet. This amount meets crop needs and provides for adequate leaching of salts. Fornes has reduced the cost of water and labor on the 70-acre field by $2,100.

Before leveling, some areas in the field were always too wet, and others always needed water. Today the water is spread evenly, and all areas have the same amount of moisture in the soil.

Before, the silt-laden water from the river rolled off the bottom of the field. Today it soaks into the ground, not only benefiting plants but also helping to leach salt out of the soil.

Before, a good irrigation man had to stay with the water all the time it was on the field. Today an irrigator gets uniform irriga-

tion and stays in the field only long enough to set siphon tubes.

Fornes is completely sold on the practice of flat leveling. "Someday, all of my land will be flat," he says. "There are disadvantages as well as advantages, but I'm very pleased with basin leveling, and I definitely recommend it."—JOHN H. FRONSKE, *district conservationist, SCS, Wellton, Arizona.* ♦

Water—even in August

Until about a year ago, farmers in Wyoming's Star Valley had more water than they needed in spring but not enough for their crops when August rolled around. Flooding along Dry Creek in spring was an annual problem.

In 1960, a group of farmers requested help from the Star Valley Soil Conservation District. The Watershed Protection and Flood Prevention Act (Public Law 566) seemed to be an answer to their problems.

A detailed plan involving sprinkler irrigation and flood-control measures was prepared with technical assistance from the Soil Conservation Service. The Star Valley Dry Creek Project required the approval of the U.S. House and Senate agriculture committees. In 1969, after Congressmen toured the area, the project was authorized for construction. In 1971, the work was completed and today this area has water—even in August.

The watershed project was needed to supply water to stabilize and improve the income of the farmers. The farmers chose a gravity sprinkler irrigation system to bring water to their thirsty fields. In such a system, the force of gravity provides the power. In mountainous areas, a pipe is used to intercept the water at a high point. The weight of the water confined in the pipe provides the pressure—the same principle is used in water-tower systems in municipalities.

Before the advent of the gravity sprinkler, farmers watched their crops grow vigorously in spring, only to see them wither in the hot August sun. Hay, which potentially could yield 3 tons, was dried out by the sun and yielded only 1 or 1½ tons. Grain, which could yield 60 to 80 bushels, yielded only about 35 bushels. Pasture, which could have produced 4 animal-unit months, produced only 3 animal-unit months.

But the sprinkler system and flood-control channel changed all that. Crops are now getting water late in summer. This was made possible by eliminating the old canal systems and replacing them with pipeline, which extends from Dry Creek Canyon down into the valley. Other pipe, like giant fingers, branches off the main pipeline, bringing water to 3,503 acres and benefiting 55 farmers.

The Dry Creek Watershed Project covers 4,280 acres of private land, 13,870 acres of land administered by the Forest Service, 157 acres under the Bureau of Land Management, and 80 acres of state land.

Much work was done high in the mountains where the water originates. Without the work carried out in national forests to control flash flooding, the sprinkler system could be ruined.

The Forest Service, on its lands, built 21,740 feet of level terraces to catch and hold water and snow. It repaired 28,900 feet of gullies and controlled erosion on 7 miles of roads and 6 miles of trails.

Gravity has brought water to Star Valley, and water has brought with it a better life for Star Valley farmers.—RICHARD L. THOMPSON, *project coordinator, Western Wyoming RC&D Project, SCS, Kemmerer, Wyoming.* ♦

SCSA plans no-tillage conference

The Erosion and Sedimentation Division of the Soil Conservation Society of America is planning a national No-Tillage Conference to be held in Des Moines, Iowa, March 28-30, 1973.

The American Society of Agronomy, American Society of Agricultural Engineers, and the National Association of Conservation Districts have been invited to cooperate in sponsoring the conference and to name members to serve on the Program Committee.

Clarence S. Britt, USDA Agricultural Research Service, Beltsville, Md., is chairman of the Program Committee; W. H. Greiner, director, Iowa Department of Soil Conservation, Des Moines, Iowa, and Dr. W. C. Moldenhauer, USDA Agricultural Research Service, Ames, Iowa, are co-chairmen of the Arrangements Committee. ♦

Review

Summary Report, the Quiet Revolution in Land Use Control. BY FRED BOSSELMAN AND DAVID CALLIES. *1971. Council on Environmental Quality. 34 pp. $0.45.* Report and analysis of innovative land-use laws and programs developed in several states during the past decade. Discusses some of the broad issues in state land-use control. The 360-page parent document, *The Quiet Revolution in Land Use Control*, is available only from the Superintendent of Documents for $2.75 a copy.

Water Supply Sources for the Farmstead and Rural Home. *Rev. 1971. USDA Farmers' Bull. 2237. 18 pp., illus. $0.15.* Water-supply systems can be developed from ground-water sources such as wells and springs or from surface-water sources such as streams, lakes, ponds, and cisterns. This bulletin discusses various water-supply systems and gives guidelines for their development.

Rebuilding a Quality Environment Through Rural Environmental Assistance Program. *Rev. 1971. USDA Agricultural Stabilization and Conservation Service. 8-page folder, illus.* Successor to the Agricultural Conservation Program, REAP offers incentive cost-sharing assistance. Folder presents questions and answers describing the environmental situation in rural America and the change that the REAP program can bring about.

Soil Erosion, the Work of Uncontrolled Water. BY R. D. HOCKENSMITH AND J. G. STEELE. *Rev. 1971.* USDA Agr. Inf. Bull. 260. *16 pp., illus. $0.10.* Soil erosion by water can occur anywhere there is enough rain to cause runoff or where land is flooded by irrigation, snowmelt, or other causes. This publication describes the process of soil erosion by water—geologic erosion, sheet erosion, rill erosion, gully erosion—and discusses the conservation practices that can be used to combat erosion.

Invite Birds to Your Home, Conservation Plantings for the Midwest. BY WADE H. HAMOR. *1971. USDA PA-982. Color folder. $0.20.* Recommends cherry, wild plum, autumn olive, dogwood, mountain-ash, cotoneaster, Tatarian honeysuckle, Russian-olive, firethorn, sunflower, redcedar, bittersweet, crabapple, barberry, American cranberrybush, holly, and hawthorn as the plants that can attract birds in the Midwest from Michigan and Indiana west to the Dakotas and Kansas.

Area Development Interchange. *Published by the National Area Development Institute, Spindletop Research Center (Lexington, Ky. 40501).* This new publication is "a national forum dedicated to development of rural areas, towns and smaller cities." Twice a month, in four to six pages, *Interchange* offers trend highlights, case studies, research findings, and reports on government programs and organizations in the field. Also offers special supplements on NADI conferences on key issues affecting area development.

Meetings

April

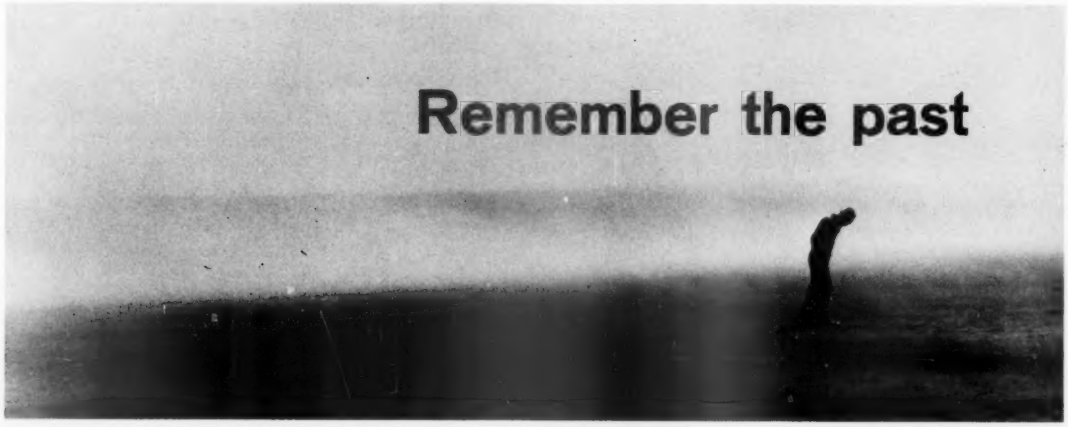
11–13 International Conference on Tropical and Subtropical Agriculture, Honolulu, Hawaii
15–20 American Society of Planning Officials, Detroit, Mich.
17–23 Earth Week '72
23–26 Association of American Geographers, Kansas City, Kans.
23–27 American Road Builders Association, New Orleans, La.
24–26 National Academy of Sciences, Washington, D.C.
30–May 4 Institute of Environmental Sciences, New York, N.Y.

May

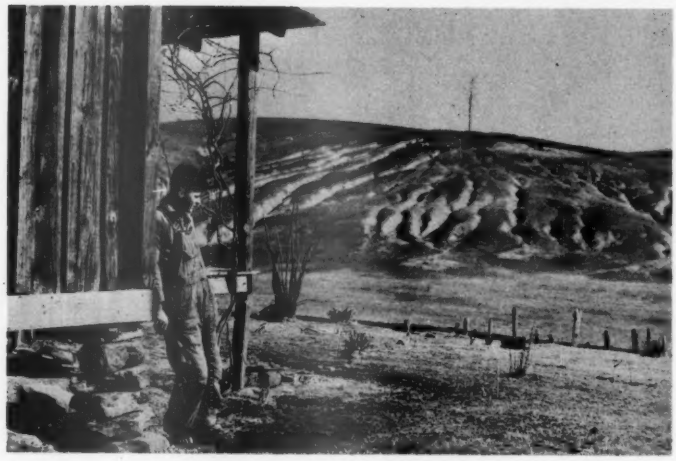
1–5 League of Women Voters of the U.S., Atlanta, Ga.
3–6 The Garden Clubs of America, St. Louis, Mo.
4 Forestry and Wildlife Forum, Virginia Polytechnic Institute, Blacksburg, Va.
4–5 Annual Southern Forestry Conference, Savannah, Ga.
7–11 The American Institute of Architects, Houston, Tex.
7–14 Soil Stewardship Week
12 Family Camping Federation, American Camping Congress, Chicago, Ill.
14–17 Annual Northeast Wildlife Conference, Allenville, N.Y.
14–18 National Council of State Garden Clubs, Inc., Cleveland, Ohio
17–June 3 International Commission on Irrigation and Drainage, Varna, Bulgaria
21–27 Urban Land Institute, 4th Annual Land Use Symposium, Toronto, Canada
23–25 Pollution Engineering and Equipment Exposition Conference, Chicago, Ill.
28–30 American Seed Trade Association, Portland, Oreg.

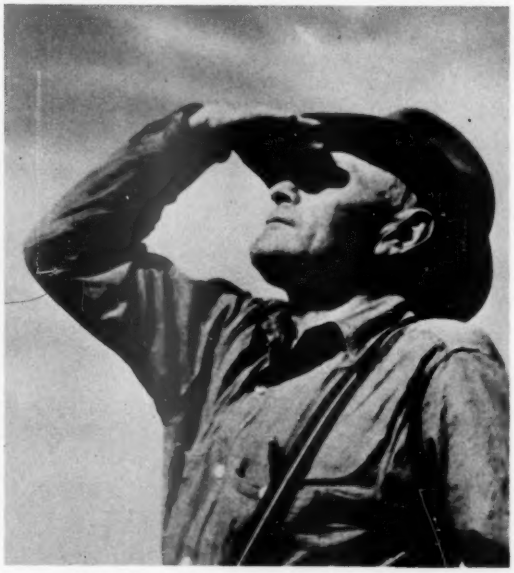
June

4–7 National Watershed Congress, San Diego, Calif.
5–16 United Nations Conference on the Human Environment, Stockholm, Sweden
8–12 General Federation of Women's Clubs, Denver, Colo.
13–18 American Water Works Association, Chicago, Ill.
14–16 Pollution Control Show and Conference, Toronto, Canada
18–22 Air Pollution Control Association, Miami Beach, Fla.
19–23 "Watershed Hydrology," National Symposium, Ft. Collins, Colo.
25–28 American Society of Landscape Architects, Philadelphia, Pa.
25–28 National Association of Counties, Washington, D.C.


Remember the past

FARM SPECIAL
THIS PLACE
FOR SALE





—then look to the future.

Okay, let's hear it once again for the good old days of unspoiled beauty, when "seldom was heard a discouraging word and the skies were not cloudy all day."

Only some of us remember it a little differently.

We remember the thirties and gullies so deep that houses could fall in and still not fill the hole. Farms so wasted and eroded that families—whole towns—packed and left for some new Eden. Ranches so poor and parched that cattle starved by the hundreds for lack of food and water. Regions where the air was so dirty and hope so gone that in 1938 an angry Kansas wheat farmer wrote a book called *Empire of Dust* and dedicated it to "the vast multitudes of homeless men and women who, being haunted by famine, disease, and death, abandoned everything, through sheer desperation, in their bid for freedom from the everlasting dust menace."

This century, this country, this land and air and water.

Of course, the land should never have been so badly scarred in the first place. But the hopeful fact is that it did come back. Not all the way and not entirely. But much of this country's land today is better than it was 40 years ago—more productive, more attractive, better used and understood.

Who helped heal it, restore it? To a large degree, the farmers and ranchers, together with the scientists and professional conservationists who worked with them.

The Soil Conservation Service played a big part. We became a Service in April 1935—37 years ago this month. We look back with pride at those who preceded us in SCS and forward with a confidence based on our history, experience, and the results we have helped landowners obtain.

We continue to have problems today in the use of land and air and water, some old ones, some new. Urban sprawl. Suburban erosion. Burning dumps. Polluted streams. Unwise land use.

These are not insurmountable problems. Today's resource users—with governmental and other help—can do the job.

If they want to. If they know how. If they work hard.

It has been done before. Americans can look at the past and remember—then look to the future and work together on our common problems.

Kenneth E. Grant

Administrator

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Recon . . .

Land is not taxed in Great Britain. This enables farmers to continue farming in areas where economics would make it prohibitive in the United States. Property taxes in England are really a variant of income taxes in that the value of land is calculated as capitalized rental value less maintenance. If the property is vacant, it is not taxed.—*County News*, March 10, 1972.

"Removal of Nitrate by an Algal System" is the first in a series of reports on bio-engineering aspects of agricultural drainage, describing results of an interagency study of nitrogen and its removal from surface agricultural waste waters of the San Joaquin Valley. The report is available from the California Department of Water Resources in Sacramento, or Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Worthless wetlands? "Wetlands are the most versatile pieces of real estate on the face of this earth. They act as sponge, reservoir, filter, factory, nursery, and refuge. They can be a living laboratory, sewage plant, oxygen producer, heat sink, firebreak, erosion control agent, and recreational area."—ART HUTT, *Florida Wildlife*, October 1971.

An international organization called **International Water Resources Association (IWRA)** has recently been founded as a nongovernmental, nonprofit scientific organization. It was incorporated in Wisconsin and has its headquarters in Milwaukee. One of the major factors in establishing IWRA was the need for a society to provide an international forum for discussing all aspects of water-resources science and technology in an interdisciplinary manner. The establishment of IWRA is the result of the efforts of an international group of administrators, engineers, executives, and scientists representing many disciplines of the water-resources field. For further information concerning objectives or membership contact: Dr. G. M. Karadi, Secretary General of IWRA, University of Wisconsin, Milwaukee, Wis. 53201.

Heat of fusion. Midwestern strawberry and vegetable growers can protect crops against frost with irrigation. Extension agricultural engineers say that protection comes mainly from the water releasing heat as it changes to ice. This is called heat of fusion. Increased humidity in the air also reduces loss of heat by radiation from the crop and the soil.

Clean fuel. A feedlot producing 100,000 cattle annually produces 150,000 tons of dry organic waste. On the basis of 10 cubic feet per pound of waste, this could be converted by anaerobic digestion into at least 3 billion cubic feet of methane worth $510,000 to $990,000 and enough to supply the natural gas needs of 30,000 people at present rates of use.—HINRICH L. BOHN, *"A Clean New Gas," Environment*, December 1971.

Hail and farewell. Hail damages crops in every section of the world. The most severe storms occur during the growing season of crops. During the 1971 crop season, devastating losses were recorded in the 48 contiguous states, plus severe losses in many European countries including France, Spain, Switzerland, Austria, and Italy. Agriculturists have learned from many years of experience that one of the ways to deal with "Mother Nature's problem child" is to carry adequate crop-hail insurance.

Sweeperettes. The Retail Merchants Board of Cleveland, Ohio, dramatized the need for litter prevention by enlisting college girls to clear trash from a local shopping district.